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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/715,282	11/16/2000	Anne E. Miller	042390.P8276	6590

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EXAMINER

CHEN, KIN CHAN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 12/18/2002

10

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/715,282

Applicant(s)

MILLER ET AL.

Examiner

Kin-Chan Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 18 November 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 12-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (US 6,077,337) in view of Watts et al (US 5,897,375; hereinafter "Watts").

Lee teaches a method of forming copper interconnect. A copper diffusion barrier layer (such as tantalum, the limitation of instant claim 7) may be formed in at least a damascene structure. A copper layer may be formed over the barrier layer. A portion of the copper layer may be removed by chemical mechanical polishing (col. 6, lines 40-42; 44-48; col. 7, lines 1-24). A slurry comprising a chelating organic acid buffer system and colloidal silica may be used for CMP (col. 5, lines 4-13). In reference to claim 6, Lee teaches, in addition to the above process steps, removing at least a portion of the barrier layer by CMP with the slurry comprising chelating organic acid buffer system and colloidal silica. Lee is silent about using a low electrochemical potential oxidizer for polishing barrier layer, therefore, it would have been obvious to one with ordinary skill in the art to polishing barrier layer without the oxidizer because it is an additional step without any benefit.

Unlike the claimed invention, Lee does not disclose using a low electrochemical potential oxidizer (such as  $H_2O_2$ ) in the slurry for chemical mechanical polishing of the copper layer. In the chemical mechanical polishing for the copper layer, Watts (col. 2, lines 30-33; col. 4, lines 54-66) teaches using the slurry comprising a oxidizer such as hydrogen peroxide (so-called a low electrochemical potential oxidizer in the instant claims) and carboxylate salt (e.g., ammonium citrate or potassium citrate). Watts teaches using the oxidizer in the slurry and through the progressive oxidation will enable effective copper CMP (col. 4, lines 50-53). Hence, it would have been obvious to one with ordinary skill in the art to modify copper CMP of Lee by using said oxidizer in the slurry as taught by Watts because Watts teaches that to do so will oxidize the top portion of the copper and enable effective copper CMP and because both use the slurry for the same purpose of copper CMP for forming copper interconnect. As to claim 6, Lee does not disclose that a copper seed layer may be formed on the barrier layer, and copper layer may be formed thereon. Watts teaches the said limitation (col. 4, line 17). Because applying said seed layer is a common practice for improving the deposition of the copper on the barrier layer and avoiding the separation, and because Watts teaches the limitation, hence, it would have been obvious to one with ordinary skill in the art to add this conventional process step as taught by Watts in order to improve the deposition of the copper and avoid the separation. The limitations of dependent claims 2 and 9 have been addressed above.

As to dependent claims 3 and 8, Lee teaches citric acid and potassium citrate (col. 5, lines 9-13).

As to dependent claims 4, 5, 10, 11, Watts teaches that the slurry may comprise corrosion inhibitor such as benzotriazole (col. 2, lines 34-35; col. 4, lines 66-67).

Because it is a common corrosion inhibitor used in the CMP slurry and because it is disclosed by Watts, hence, it would have been obvious to one with ordinary skill in the art to use same in the process of Lee in order to provide their art recognized advantages and produce an expected result.

In reference to dependent claim 11, Lee (col. 4, lines 52-53) teaches the slurry has a pH in the range of 2 to 4, which is within the range cited.

### ***Response to Arguments***

3. Applicant's arguments filed on November 18, 2002 have been fully considered but they are not persuasive.

Applicant has argued that neither Lee nor Watts teaches or suggests polishing with a slurry having a low electrochemical potential oxidizer and a chelating organic acid buffer system. As stated in the office action, Lee teaches that a slurry comprising a chelating organic acid buffer system and colloidal silica may be used for CMP (col. 5, lines 4-13), and Watts teaches using the slurry comprising a oxidizer such as hydrogen peroxide (so-called a low electrochemical potential oxidizer in the instant claims) and through the progressive oxidation will enable effective copper CMP. Hence, it would have been obvious to one with ordinary skill in the art to modify copper CMP of Lee by using said oxidizer in the slurry as taught by Watts because Watts teaches that to do so

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will provide progressive oxidation and enable effective copper CMP. Therefore, the combined prior art teaches limitations of the claimed invention.

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In re Merk & Co., Inc., 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant has argued that there is no motivation to combine the reference, because Lee specifically teach using ferrocenium salt as the oxidizer, and neither Watts nor Lee suggest the benefits obtained by utilizing a low electrochemical potential oxidizer. In response, Lee does not limit to only one oxidizing agent for CMP polishing. Rather, Lee teaches that ferrocenium salt may be used as one of the CMP oxidizing agent to eliminate a need for these additional waste treatment process procedures (col. 3, lines 53-55), and Watts teaches, as has been stated in the office action, using H<sub>2</sub>O<sub>2</sub> (so-called low electrochemical potential oxidizer in instant claims) in the slurry for copper CMP for forming copper interconnect will provide progressive oxidation and enable effective copper CMP.

### ***Conclusion***

**4. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

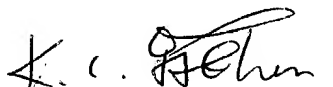
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.

K-C C  
December 17, 2002

  
Patent Examiner  
Group Art Unit 1765